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designers' intentions, "their responses were indeed quite similar to the original idea." But this is meaningless as a research finding, because neither the similarity scale nor the expected similarity are defined. On the same token, what is presented as *preliminary conclusions* could be more cogently called *teacher's assumptions*: the critical question is not whether they have been proved, but whether they have been effectively taught. The author has a legitimate claim about the educational value of his work, and perhaps even about the originality of some of the spatial formations produced; claiming in addition to have conducted an experiment obscures the value of his contribution.

In summary, I would like to commend Alex Maller for having addressed a complex problem, for basing his teaching on solid theoretical foundations and for subjecting his work to public scrutiny. In turn, I would like to thank *Leonardo* for making possible this debate.

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REPLY TO J. P. BONTA AND Y. FRIEDMAN

J.P. Bonta and Y. Friedman in their comments on my paper outline the need to connect architectural study to human reality.

The Three-Dimensional Basic Design Studio, of which the paper presented a general description, is an integral part of the wider frame of architectural studies undertaken in our school throughout the first year.

The compulsory design studies of the first year are divided into two parallel courses: Architectural Design and Basic Design. Since I have the privilege of teaching both courses, I have a fair judgement of the teaching pattern and its elements. The purpose of the separation is to gradually introduce students to the complexity of architectural essence by emphasizing fundamental concepts like dwelling, structure and communication in their own right.

The architectural design course is mainly focused on analyzing and experiencing dwelling and structural dimensions of architecture, related to human uses and human behavior. The basic design course, and in particular the Three-Dimensional Studio, focuses mainly on experiencing and understanding the communicative and structural dimensions of design.

This pedagogical pattern gives students opportunities to become aware of the variety of thoughts and aptitudes necessary to dvelop their analytical and creative capacity. It allows them as well to start considering their approach to architecture using systematic methods, to participate actively in critical discussions and to become involved in the polemics on various architectural subjects.

I agree with Yona Friedman that real-scale representation is an important aspect in teaching architecture. The artifacts produced by the students in the Three-Dimensional Studio are real-scale representations. These are not simulation models but are meant 'to speak for themselves'—to communicate to observers the student's concept expressed in concrete means. Other exercises (which have not been illustrated in the article) focused on the realization of 'places' and 'events', have developed concepts which enabled individuals or groups to penetrate into the designed space and test the student's spatial intentions. However, those exercises were not meant to become dwelling solutions but experiments intended to clarify, in real terms, abstract thoughts. I believe that in the first year it is premature to ask untrained students to create real-scale solutions, ready for use.

The design process was influenced by mutual criticism among students themselves, as well as by tutors and visitors, as Bonta has rightfully assumed. The study is not intended to reach an "uninhibited expression" but one divorced from stereotypes and fashion—open, critical and experimentally minded. The results of this fragmentation and restructuring process are meant to shape a basis for further studies in architectural design. It is in later studies that the synthesis of the various architectural dimensions should be elaborated and realized.

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COMMENTS ON "SOLAR-POWERED KINETIC SCULPTURE: A COLLABORATIVE EDUCATIONAL EXPERIMENT"

The above article by Stonyer *et al.* (*Leonardo* **19**, 35–38, 1986) seems to me a step in the right direction. Art should be joy, and there are few things in this world that have as strong and enjoyable an impact as sunlight—an impact that is not used enough in art–technology. I have a few suggestions for further development of the research, as well as a few questions to the researchers.

I had the impression that the researchers had given all their time for years to various technical developments and experiments. In my opinion now would be the time to stop for a philosophical analysis: What have we achieved? Or what use is this achievement for humankind? Answers to these questions would indicate the ideal goal of the research and the ideal method to make humankind aware of this work.

In my opinion the most important achievement in this work is the creation of a sculpture technique that shows the seasons of the year. A country dweller sees the seasons by the change of his surroundings. The authors have developed a sculpture technique that can make city dwellers aware of these seasonal changes. The technique can be used for big monuments in cities, but also as small artifacts inside and outside of apartments. Wherever sunlight strikes, the technique will work. I believe this technique has another important possibility, not yet developed. Modern people are too passive, sitting before the television screen, etc. The public should become an active partner in these sculptures. An observer moving around the sculptures will throw a shadow, stopping light- and heat-rays. In addition observers might possibly be permitted to move and handle parts of the sculpture.

I want to unite visual art with music. I have achieved this by uniting my sun-projections with music, composed especially for them and performed by an orchestra. But I wanted my art-robots to make sun-projections and music by themselves. I experimented with solar cells, which activated electrical motors connected to sound-instruments. I found I could produce sound this way, but nothing that I would call music. So I gave it up. Stonyer *et al.* also have experimented with sound. Have they achieved something that might be called music?

The authors had the rare experience of working for years as a team of artists and scientists. Do they believe this to be a way for creating great art, or is it only a method for developing art–technology?

And finally, has a sculptor using the authors' method the same unlimited possibilities for creating the three-dimensional forms he or she wants, as in traditional sculpture techniques, or is he or she limited in this freedom?

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